

DEVELOPMENT OF THE MULTI-SCALE METHOD FOR LSI LITHOGRAPHY MASK

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Recently, there is a strong demand for high-density and high-quality LSI for smaller LSI design. Low energy electron-beam proximity projection lithography (LEEPL) is one of the lithography techniques for LSI production. The pattern image of device is transferred to the wafer by a single crystal silicon mask (LEEPL Mask) (Fig.1). In order to write the mask pattern to wafer accurately, the information on the exact position of a mask is needed. So, absolute position of mask is estimated by the structural analysis.

Actual LEEPL Mask has the complicated pattern (Fig.2). Model size becomes very huge to calculate the minimum mask pattern. It is impossible to calculate the whole mask using the detailed FEM mesh. So, we propose analysis method for LEEPL Mask. First, the whole mask is divided into small domains. Next, the relationship between local mask pattern and stiffness is investigated. The Equivalent stiffness of typical patterns of them is calculated. Finally, the whole mask is analyzed using the stiffness of local mask. We can analyze the whole mask in short calculation time by this method. And, the complicated irregular nature of a mask pattern can also be taken into consideration.

In this paper, local pattern equivalent stiffness is considered. And, the validity of our proposed method is also demonstrated by multi-scale analysis of simple whole mask.

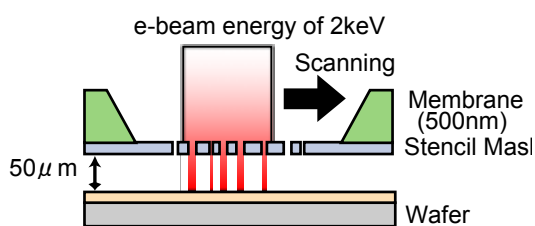


Fig.1 LEEPL

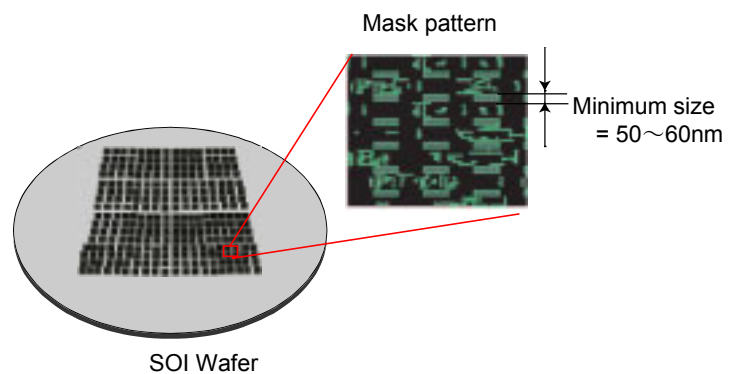


Fig. 2 LEEPL Mask

References

- [1] Takao Ustumi, "Low energy e-beam proximity projection lithography", *J. Vac. Sci. Technol. B*, Vol.17, No.6, pp.2897-2902, 1999.
- [2] Terada, K. et al., "Simulation for representative volume elements and multi-scale convergence (in Japanese)", *Proceedings of the Conference on Computational Engineering and Science*, Vol.3, pp.1019-1022, 1998.